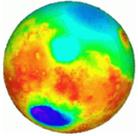


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# Potential MSL Outcomes and Discovery Response

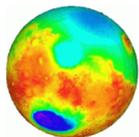
**Joy Crisp, David Beaty, and David DesMarais**  
**MEPAG Meeting held March 3-4, 2009**



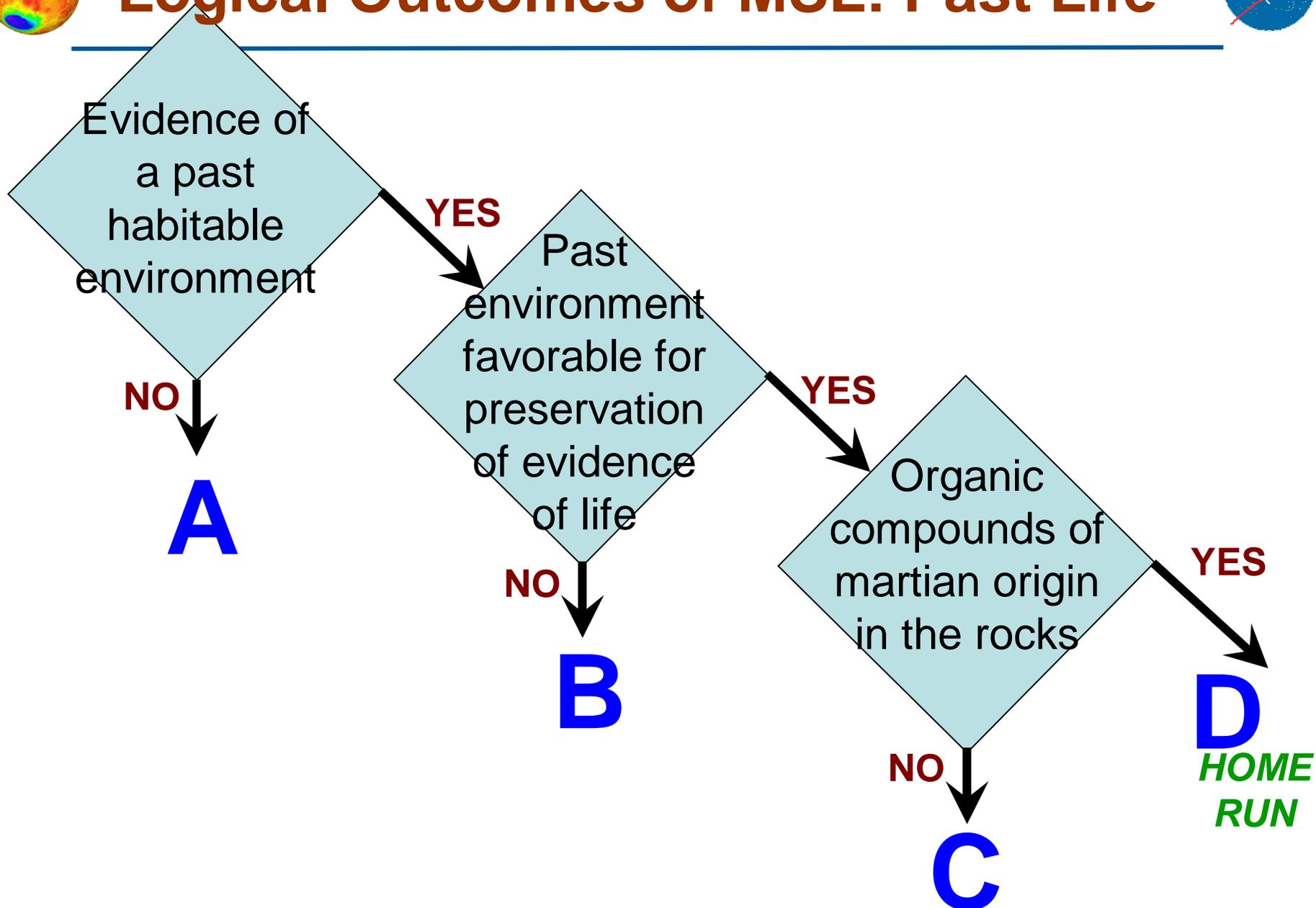
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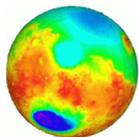
**This is one component of  
inputs to MATT-3 Question 6:**

***What are the science  
objectives and program goals  
for a possible 2018 rover /  
lander in a  
U.S.-only program?***

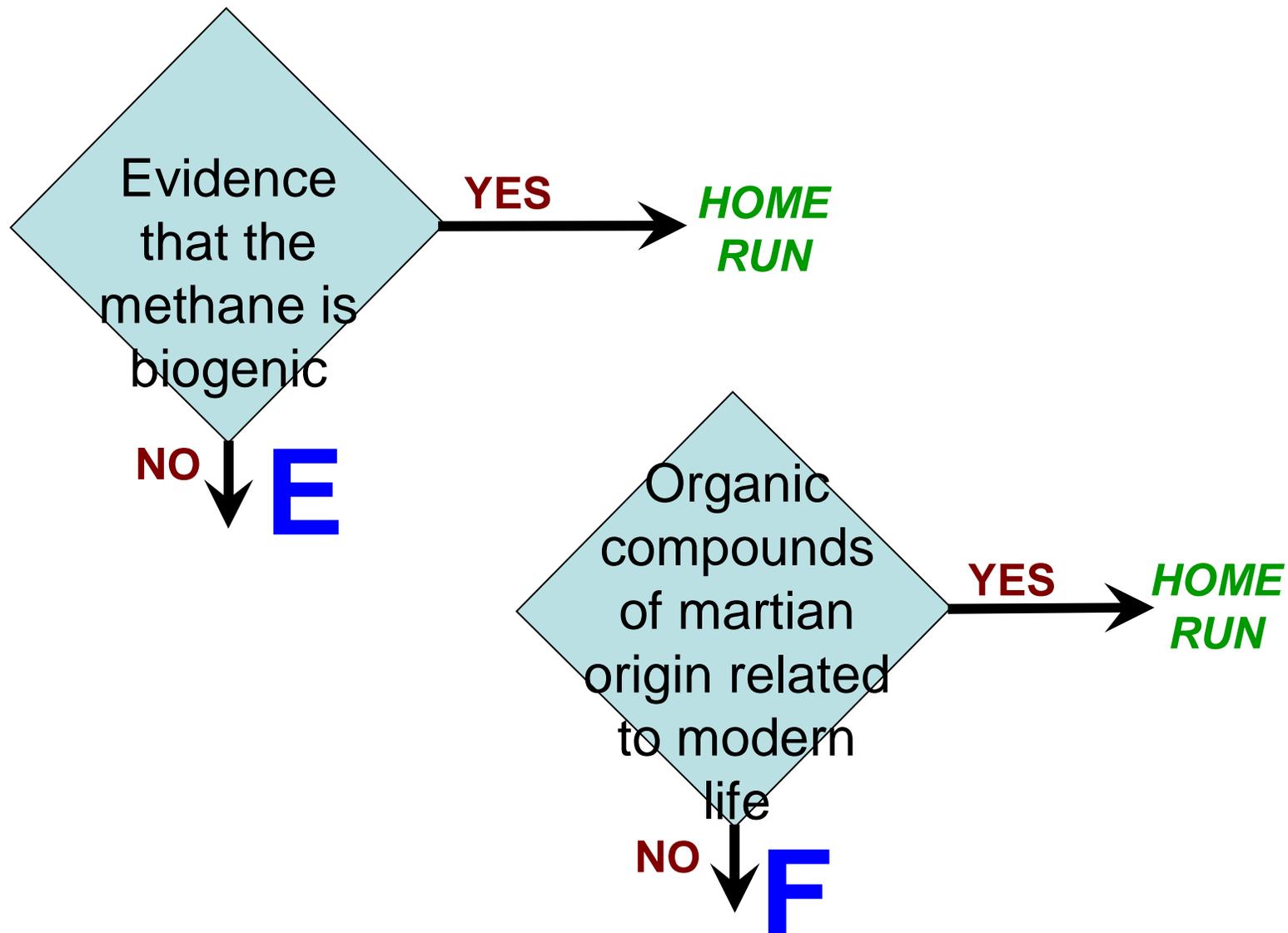


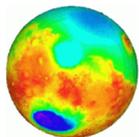
# Logical Outcomes of MSL: Past Life



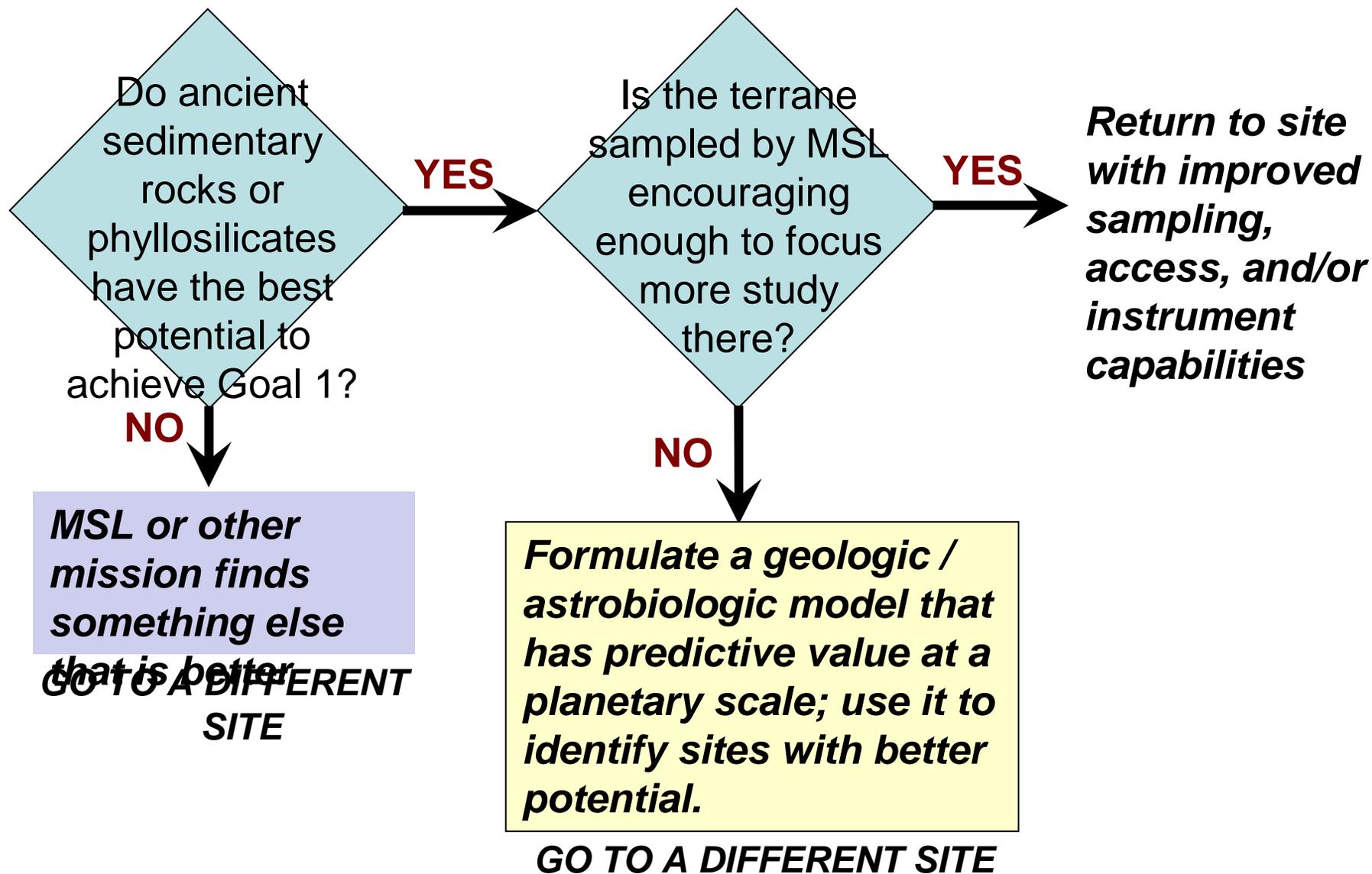


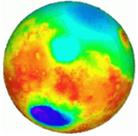
# Logical Outcomes of MSL: Modern Life





# MSL as a Test of MEPAG Strategies





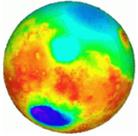
# Hypothetical Examples

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**The following are four HYPOTHETICAL examples just to show some of the KINDS of outcomes that might result from MSL.**

**They are not meant to be predictions for particular landing sites.**



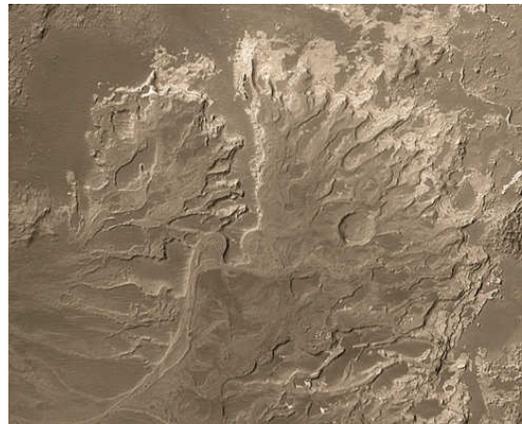
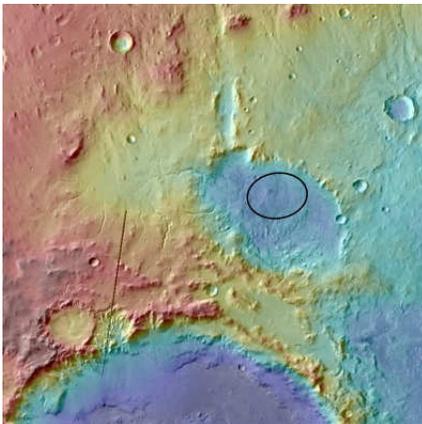
# Hypothetical Example

## MSL Outcomes: 1 of 4

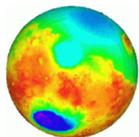
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**MSL goes to the delta deposits of Eberswalde. The delta depositional environment is confirmed, but we discover that this kind of facies on Mars is not good for preservation of organic compounds and evidence of fossil life. The clay minerals are limited to thin rock coatings, with minimal amounts of water involved in their formation. There is no sign of organic compounds, likely due to the oxidant compounds found in the rocks. We decide that a better landing site for meeting Goal 1 is one where the phyllosilicates were associated with aqueous deposition in the sediments of lakes having a longer history of aqueous activity.**



**Scenario  
B**

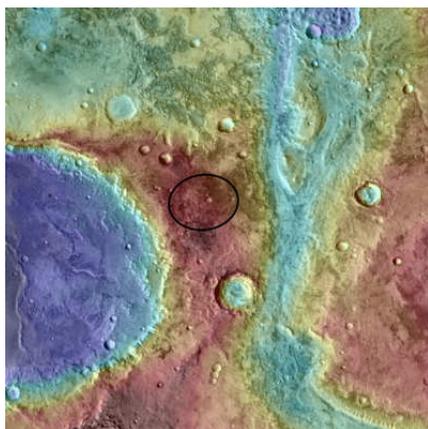


# Hypothetical Example

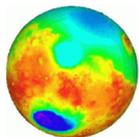
## MSL Outcomes: 2 of 4



At Mawrth Vallis, MSL discovers evidence for past environments favorable for life and potentially favorable for preservation of evidence of past life, but no Martian organic compounds are detected. The phyllosilicate deposits turn out to be pyroclastic airfall deposits that were altered by groundwater. We decide that a better landing site for meeting Goal 1 might be one in which there is clearer evidence for water-lain sedimentary deposition.



**Scenario**  
**C**



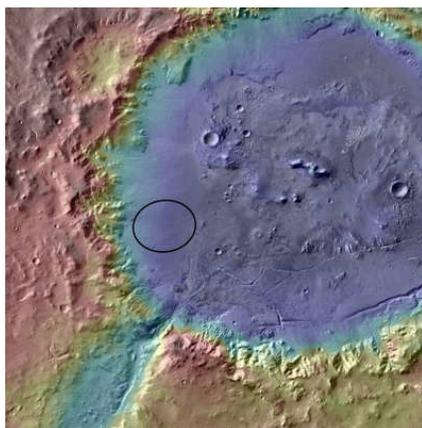
# Hypothetical Example

## MSL Outcomes: 3 of 4

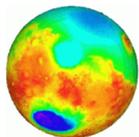
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At Holden Crater, MSL's SAM instrument finds organic compounds of potentially martian origin in only the deepest (5cm depth) drill holes. MSL's RAD instrument results, combined with models, indicates that 10 cm would be an optimum minimum depth for finding preserved organic compounds. A follow-up rover or lander mission with deeper drilling capability, to Holden or a previously unvisited site, is being considered.



**Scenario  
C or D**

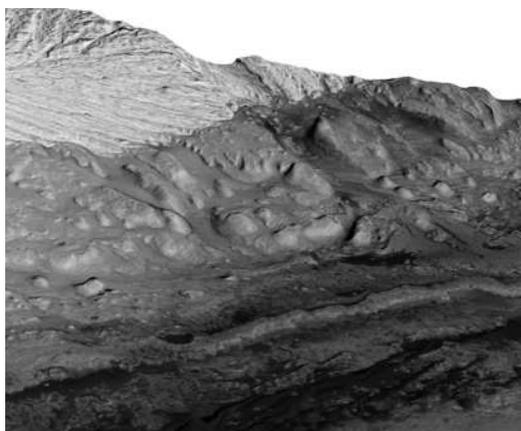


# Hypothetical Example

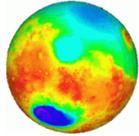
## MSL Outcomes: 4 of 4



MSL goes to Gale Crater and studies a cross section of materials starting in phyllosilicate-rich materials in the lower part of the section. The rover reaches the sulfate-rich materials two weeks before the end of the mission, but in those two weeks, organic compounds of possible martian origin are finally discovered. Assessment of orbital imagery has revealed an even stronger connection between the sulfate-bearing deposits on Mars and long-lived liquid water on the surface. A follow-up rover mission to return to the sulfate materials at Gale is now high-priority, due to the limited characterization and exciting results.



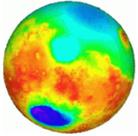
**Scenario  
D**



# Types of MSL outcomes and likely follow-up



<b>MSL OUTCOME</b>	<b>FOLLOW-UP MISSION POSSIBILITIES</b>			
	<b>Rover to Same (S) or Different (D) Site</b>	<b>Instrument (I) or Rover (R) capability</b>	<b>Vertical access</b>	<b>MSR</b>
<b>Habitable past environments, no organics in</b>	D			
<b>Past environments not good for preserving</b>	D			
<b>Incomplete assessment of compelling</b>	S			M
<b>Tantalizing interpretations but with ambiguity</b>	S or D	I or R		
<b>Interesting organic compounds in the soil but not in the rocks</b>		I	V	M
<b>Incomplete assessment of noncompelling</b>	D			
<b>Instruments or rover/tools did not work as</b>	S or D	I or R		
<b>Methane source information or origin clues</b>	S or D	I or R		
<b>Interesting organic compounds in the rocks</b>	S			M



# Conclusions

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Most probable outcomes in response to MSL lead to a rover mission to the same or a different site.

Lower probability, but some scenarios may lead to a follow-up mission with vertical access or MSR.

It would be sensible to add a cache to the follow-up mission in case it leads to MSR.